Claims:

1. A method of examining a sample by means of mass spectrometry, according to which method

- the solution comprising the sample to be examined is vaporised in a vaporiser;
- the vaporised sample solution is sprayed, using a gas flow, into a corona discharge zone, where the sample to be examined is ionised using a corona discharge to generate gas phase ions; and
- the ions are separated and directed to a detector,

characterized by

- using a vaporiser which is fabricated as a micromechanical structure.

2. A method according to Claim 1, characterized in that a vaporiser is used which comprises flow channel networks for the solution and for the carrier gas possibly used for the feeding of the solution, as well as a heater of the vaporiser, which are all included in a monolithic structure.

3. A method according to Claim 2, characterized in that the flow channel networks are dimensioned so that the volume of the liquid flow passing through them is less than 100 µl/min, most suitably less than 10 µl/min.

4. A method according to Claim 2 or 3, characterized in that a vaporiser is used which comprises a vaporising zone and a corona discharge zone, which are integrated into a single micromechanical structure.

5. A method according to any of the preceding claims, characterized in that a micromechanical structure is used which comprises flow channel networks designed for one or more wafers, and a heater.

6. A method according to Claim 5, characterized in that a structure is used which comprises

- a substrate wafer in which flow channel networks for gases and liquids are formed, and
- a cover wafer, attached to the substrate wafer in which a heater for vaporising the sample solution, is patterned.

7. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the vaporised sample solution is ionised with a corona discharge in the presence of air, at normal atmospheric pressure.

8. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the corona discharge zone comprises a needle-shaped electrode, which is connected to a voltage which is so high in relation to the curtain plate of the mass spectrometer that the electric field strength, at least in the immediate vicinity of the tip, exceeds the corona discharge threshold of air.

9. A method according to Claim 8, c h a r a c t e r i z e d in that the potential of the needle-shaped electrode in relation to the curtain plate is at least 1 kV, and the maximum electric field strength near the tip of the electrode is approximately 50 kV/mm.

10. A method according to any of the preceding claims, c h a r a c t e r i z e d in that polar compounds, non-polar compounds, neutral compounds or ionic compounds are examined, and the sample to be examined is dissolved in a polar or non-polar solvent, used as the eluent; to generate the sample solution.

11. A method according to Claim 10, c h a r a c t e r i z e d in that compounds are examined, the molar masses of which are at most 2000 Da, most suitably at most 1000 Da.

12. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the flow of liquid of the sample to be examined is set at a value which is lower than approximately 10 µl/min, and the flow of the carrier gas used for feeding the sample is set at a value which is at least approximately 50 µl/min.

13. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the sample is ionised using the Atmospheric Pressure Chemical Ionization (APCI) method.

14. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the gas flow used for the injection is brought in essentially perpendicular to the flow direction of the sample.

15. A method according to any of the preceding claims, c h a r a c t e r i z e d in that the gas flow is fed into the device in the flow direction of the liquid and before the feed opening of the liquid.

16. A method according to Claim 14 or 15, c h a r a c t e r i z e d in that the gas flow is fed through one feed opening, in order to distribute the gas flow around the liquid flow comprising sample, and, as a result, a homogeneous mixture is achieved.

17. An apparatus for examining a sample by means of mass spectrometry, comprising

- a vaporiser for vaporising the solution comprising the sample to be examined,
- a corona discharge device, connected to the vaporiser, in which the sample to be examined is ionised according to the Atmospheric Pressure Chemical Ionization (APCI) method, to generate charged particles,
- a detector, connected to the corona discharge device, to detect charged particles, and
- means for directing the charged particles, using electric and/or magnetic fields, from the corona discharge device to a detector,

c h a r a c t e r i z e d in that

- the vaporiser is fabricated as a micromechanical structure.

18. An apparatus according to Claim 17, c h a r a c t e r i z e d in that the vaporiser comprises flow channel networks for the solution and for carrier gas possibly used for feeding the solution, and a heater of the vaporiser, which are all included in a monolithic structure.

19. An apparatus according to Claim 18, c h a r a c t e r i z e d in that the flow channel networks are dimensioned so that the volume of the liquid flow passing through them is less than 100 µl/min, most suitably less than 10 µl/min.

20. An apparatus according to Claim 18 or 19, c h a r a c t e r i z e d in that the vaporiser comprises a vaporising zone and a corona discharge zone, which are integrated into a single micromechanical structure to form a combined vaporiser and corona discharge device.

21. An apparatus according to any of the Claims 17-20, c h a r a c t e r i z e d in that it comprises a monolithic block which is formed of two or more parts which are connected to each other.

22. An apparatus according to Claim 21, c h a r a c t e r i z e d in that the block comprises a

silicon wafer in which flow channel networks for gases and liquid are formed, and a glass plate in which a heater for vaporising the sample solution is formed.

23. An apparatus according to Claim 21, c h a r a c t e r i z e d in that the block comprises a glass plate in which flow channel networks for gases and liquid are formed, and a silicon wafer in which a heater for vaporising the sample solution is formed.

24. An apparatus according to any of the Claims 17-23, c h a r a c t e r i z e d in that the corona discharge device comprises a needle-shaped electrode, which is connected to a potential which is so high in relation to the curtain plate of the mass spectrometer that the electric field strength, at least in the immediate vicinity of the tip of the electrode, exceeds the corona discharge threshold of air.

25. An apparatus according to Claim 24, c h a r a c t e r i z e d in that the potential of the needle-shaped electrode in relation to the curtain plate can be set at a value which is at least 1 kV, and the maximum strength of the electric field near the tip of the electrode can be set at approximately 50 kV/mm, at least.

26. An apparatus according to any of Claims 17-25, c h a r a c t e r i z e d in that it is fabricated entirely as a glass structure.

27. An apparatus according to any of Claims 17-26, c h a r a c t e r i z e d in that the flow channel system of the carrier gas used for feeding the solution is connected to a feed nozzle of the gas, which nozzle is located upstream in the flow direction of the solution and through which gas can be fed into the device essentially perpendicular to the flow direction of the solution.

28. A device according to Claim 27, c h a r a c t e r i z e d in that the gas flow fed through the feed opening can be distributed around the flow channel system of the solution in order to achieve a homogeneous mixture.

29. A device according to any of the Claims 17-28, c h a r a c t e r i z e d in that the heater comprises heating resistors, the foreparts of which are made wide in order to decrease the flow resistance and which are made narrow only near the mixing zone of gas and liquid, where they act as heating resistors and form the actual heating zone.

30. Use of a vaporiser, fabricated as a micromechanical device, to generate a vaporised sample which is fed to be ionised according to the Atmospheric Pressure Chemical

Ionization (APCI) method.

31. Use according to Claim 30, c h a r a c t e r i z e d in that a vaporiser is used, which comprises a monolithic block, in which at least the carrier channel networks for the sample to be examined and for the carrier gas possibly used for feeding the sample, as well as the heater for vaporising the sample are formed, in which case the flow channel networks are dimensioned so that the flow volume passing through them is less than 100 µl/min.

32. Use according to Claim 31, c h a r a c t e r i z e d in that the vaporiser is used for examining a sample, the molar mass of which is at most approximately 2000 Da.